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FIRST PROGRESS REPORT OF INVESTIGATION FROM JAPANESE MAGSAT TEAM*

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TITLES OF JAPANESE MAGSAT INVESTIGATIONS (Statement of Work #M-43)

A. Crustal Structure near Japan and its Antarctic Station
   - A-1. Regional Magnetic Charts
   - A-2. Local Magnetic Anomalies and Their Origin
   - A-3. Crustal Structure in the Antarctic

B. Electric Currents and Hydromagnetic Waves in the Ionosphere and the Magnetosphere
   - B-1. Ionospheric and Magnetospheric Contributions to Geomagnetic Variations
   - B-2. Field-Aligned Currents
   - B-3. Geomagnetic Pulsations and Hydromagnetic Waves

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* The Japanese MAGSAT Team consists of the following members:

N. Fukushima (Chairman), H. Maeda (Vice-Chairman), T. Yukutake (Secretary), M. Tanaka, S. Oshima, K. Ogawa, M. Kawamura, Y. Miyazaki, S. Uyeda, K. Kobayashi, M. Kono, N. Sumitomo, K. Kaminuma, T. Araki, A. Suzuki, T. Iijima, H. Fukunishi, Y. Kamide, T. Saito

The team has also the following collaborators in data analysis:
M. Ejiri and H. Sakurai (National Institute of Polar Research, Tokyo 173), M. Yanagisawa (Inst. Space & Aeronautical Sci., Univ. Tokyo, Tokyo 153).

1. Introduction

Since the Japanese MAGSAT Team has 18 registered Co-Investigators for 6 different subjects (3 each for internal and external magnetic fields), the progress reports will be prepared in the following way, i.e. a summary of all investigation results is written by the Principal Investigator, and the details of each investigation will be attached as Appendices as appropriate.

It is necessary for the Japanese Team to distribute copies of the MAGSAT tapes to Co-Investigators working at different places within Japan. By courtesy of the kind offer from the Data Processing Division of the National Institute of Polar Research (abbreviated hereafter to NIPR), MAGSAT data received by the Principal Investigator are being handled first by NIPR for easier analysis by Co-Investigators.

For the past four months, most efforts have been concentrated on compiling tapes which contain vector and scalar data decimated at an interval of 0.5 sec, together with time and position data. Regarding the data analysis, progress was seen particularly in the study of field-aligned currents above the ionosphere. CHRONINT data was quickly examined for the path over Japanese area, and the feasibility was confirmed with scalar data of providing useful information about long wavelength magnetic anomalies. Analyses of vector anomalies are planned with CHRONFIN data.

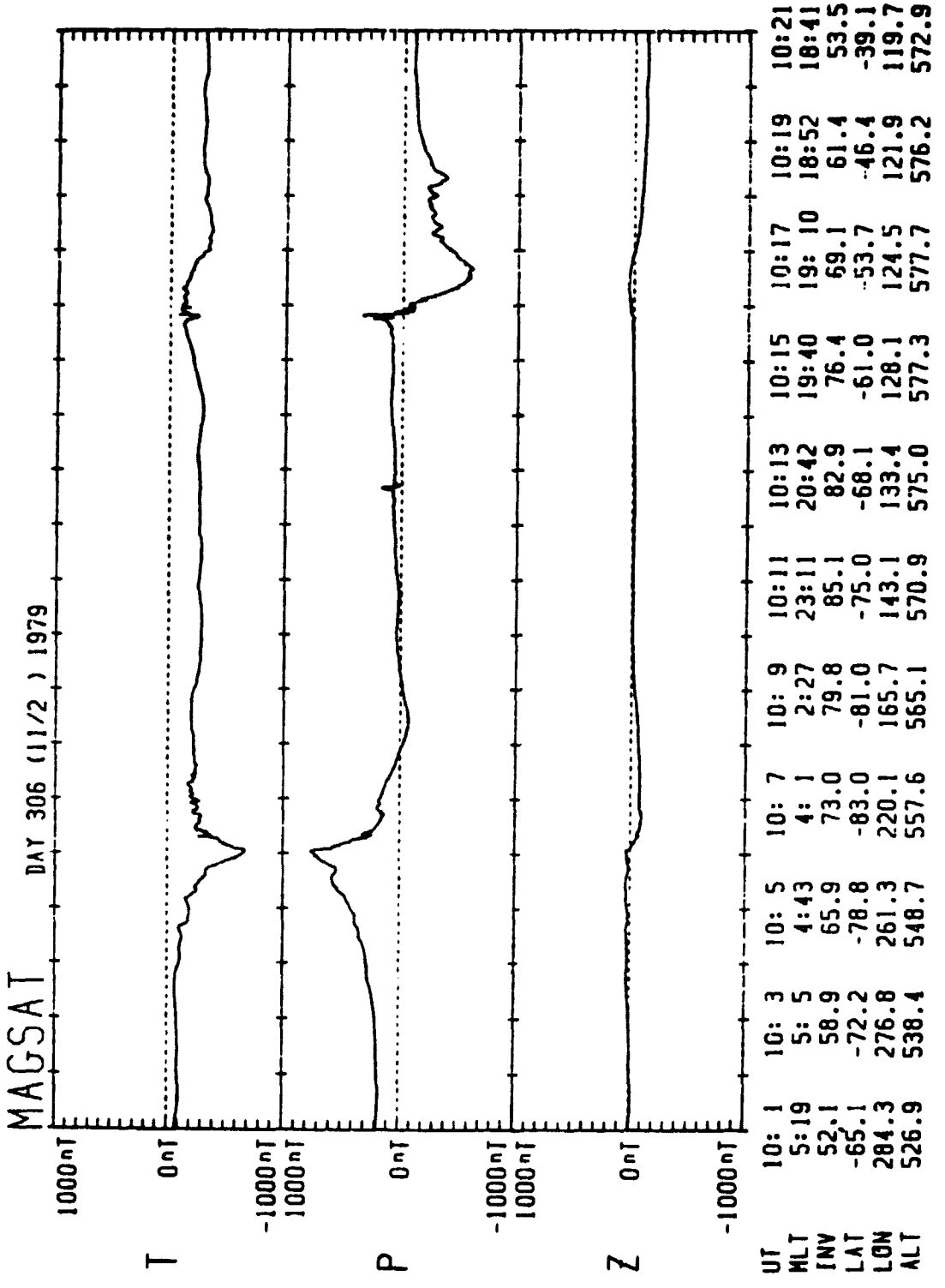
2. Graphical Display of MAGSAT Data.

From the original CHRONINT data tapes received from NASA, a compilation of data is being carried out at NIPR, so as to obtain

(a) satellite path over the world map,

(b) scalar value plotting over the world map,

(c) three-component (T, P and Z) residuals from the MGST(3/80) model with the indication of UT, magnetic local time, invariant latitude, geographic longitude and altitude (an example of this diagram is shown on the next page).


MAGSAT
DAY 306 (11/2) 1979
T
P
Z
1000nT
0nT
-1000nT
UT 10: 1 10: 3 10: 5 10: 7 10: 9 10:11 10:13 10:15 10:17 10:19 10:21
MLT 5:19 5: 5 4:43 4: 1 2:27 23:11 20:42 19:40 19: 10 18:52 18:41
INV 52.1 58.9 65.9 73.0 79.8 85.1 82.9 76.4 69.1 61.4 53.5
LAT -65.1 -72.2 -78.8 -83.0 -81.0 -75.0 -68.1 -61.0 -53.7 -46.4 -39.1
LON 284.3 276.8 261.3 220.1 165.7 143.1 133.4 128.1 124.5 121.9 119.7
ALT 526.9 538.4 548.7 557.6 565.1 570.9 575.0 577.3 577.7 576.2 572.9

3. Ground Magnetic Data.

The height-dependence of the local magnetic anomaly over Japan is being studied by model calculation. For example, S. Oshima is calculating the geomagnetic total intensity anomalies at 300-500 km altitude above Japan and adjacent sea areas, by an upward continuation technique from the ground data (based on the airborne magnetic survey data of 1973-1977 conducted by the Hydrographic Department of Japan), in order to compare them with the MAGSAT data.

The world magnetograms during the period of MAGSAT observations are being collected for the comparison of satellite and ground data. T. Iijima and R. Fujii are trying to compare the provisional field-aligned signatures with the simultaneous magnetic variations on the ground in high latitudes, wheras H. Maeda is wishing to analyze the Sq variation as early as possible with the data inflow from various regions of the world.

4. Preliminary Results of MAGSAT Data Analysis.

For studying local magnetic anomaly, M. Kono and M. Yanagisawa quickly examined the total intensity data of CHRONINT on a few paths over Japan and its neighbouring sea area and they found the MAGSAT data extremely useful. Regarding vector data, however, we are awaiting CHRONFIN tapes and more details will be given with the coming trennial report.

In high latitudes the signatures of field-aligned currents are clearly recognized. From an inspection of the initial CHRONINT data, we see the following characteristics of field-aligned currents: (1) the persistent basic pattern of current flow (so-called Regions 1 and 2, known from the analysis of TRIAD data), with the dominance in intensity of Region 1 (pole-side) current over Region 2 (equator-side) current, and with greater variability of Region 2 current presumably depending on the substorm activity; (2) more intense currents in both Regions 1 and 2 in the summer hemisphere than in the winter hemisphere; (3) more fluctuations in current intensities (small-scale variations in time, or space, or both, superimposed on and adjacent to Regions 1 and 2 currents) in summer dawn hours; (4) apparent dawn-dusk asymmetry in the field-aligned current intensity between the north and south polar regions.

5. Publications

Only oral presentations have been made until now using the actual MAGSAT data, but one paper relating to an idea for analysis has been submitted for publication. The papers presented were:

H. Sakurai, M. Ejiri, T. Iijima and N. Fukushima, Reduction of MAGSAT data and comparison with relevant geophysical data (1).

N. Fukushima, T. Iijima, R. Fujii and H. Sakurai, Field-aligned current signatures in MAGSAT data.

M. Kono and M. Yanagisawa, Preliminary result of MAGSAT data analysis.

H.M. Maeda, T. Araki, A. Suzuki and T. Kamei, Analysis of geomagnetic variation field with MAGSAT data.

All of these papers were presented to the 68th Semi-annual Meeting of the Society of Terrestrial Magnetism and Electricity of Japan. The last paper deals with an idea for future analysis and this has already been submitted by H. Maeda for publication in the Journal of Geomagnetism and Geoelectricity.

6. Problems

It takes some time in Japan to distribute the MAGSAT data to Co-Investigators because of the processing and copying first in NIPR. However this will cause only a slight delay in starting the actual analysis by Co-Investigators. The future supply of Investigator tapes from NASA will remedy the disadvantage in the Japanese MAGSAT Team.

7. Data Quality and Delivery

All the MAGSAT tapes so far received have been very useful for carrying out the studies by the Japanese MAGSAT Team. Even the CHRONINT data are very useful for knowing the field-aligned current characteristics. Some comments on future arrangements are written in the next Section. (These comments excepting [6] were presented for discussion at the MAGSAT Investigators' meeting on December 4-5, 1980.)

8. Recommendations

[1] Very Quiet Days and Quiet Days. It would be useful to select some special days for intensive study, such as very quiet days and quiet days.
Very Quiet days ($Ap \leq 3$, $Cp=0.0$): 1979 November 5, 22, 28; December 25; 1980 February 12, 13; March 2, 12, 15.
Quiet days ($Ap \leq 3$, $Cp \leq 0.1$): 1979 November 6, 15; December 23; 1980 January 9, 10; February 3, 5; March 1; April 2; May 3, 16, 17, 27.

[2] Orbit Numbering. Instead of (or in addition to) the serial number of the MAGSAT orbit, it would be convenient for all MAGSAT investigators if a special common numbering is introduced, with which we could immediately identify the approximate track of MAGSAT over the earth. This would be especially useful in the near future in listing the MAGSAT orbits used in our scientific reports. There may be of course various ways of assigning this kind of path num bering. The one proposed here is given by nine-digit numbers (written here AABBCCDDD); AA denotes the months from November (11) to June (06) omitting the year 1979 or 1980, BB is the number of days from 01 to 31 in each month, CC is the nearest universal time in hour from 00 to 24 at the equator crossing of the northbound orbit, DDD is the nearest east longitude in degree from 000 to 360 of the point of equator crossing. In this way we can know immediately the date and approximate geographic locations of each MAGSAT track over the world. It would be very convenient to prepare in advance a conversion table from serial orbit number to this special numbering.

[3] Reference Field for Internal Magnetic Field. Although there will be a great deal of discussion on the choice of the best reference field, we hope that the December 1980 meeting will recommend to us the one which is to be preferably used in the future analysis. (In Japan we decided in our meeting in July 1980 to adopt MGST 3/80 model, but we will follow your advice on the model field.)

[4] CHRONINT and CHRONFIN. CHRONINT data so far received are still very useful for the study of field-aligned currents above the ionosphere, despite their inaccuracy in the axis identification. However, if NASA needs more budget for deriving the CHRONFIN data, and if the curtailing of CHRONINT tape production saves a lot of expenses, we would like to suggest that NASA give first priority to the derivation of CHRONFIN data.

[5] Scalar Data. If the supply of vector magnetic field data for the entire MAGSAT observation period must be considerably delayed due to some unexpected trouble in the final coordinate transformations and corrections, it would be worth considering compilation of the tapes of only scalar data with orbit information for the whole of the MAGSAT observation period.

[6] Investigator B tape. For the investigators working on the crustal structure, it would be beneficial to have Investigator B tapes as quickly as possible. It would therefore be appreciated if the tapes were created and distributed at short time intervals, every two months for instance.

9. Conclusions

It is of great benefit to the geophysical community in Japan to receive a set of MAGSAT data from NASA. We hope to be able to report a series of important conclusions in the coming trennial reports, although only some provisional results are written this time in the first report.

In Japan an advisory committee for MAGSAT Investigation was set up in September 1979 in the National Committee for IUGG, with the purpose of (i) giving appropriate scientific advice to the MAGSAT Team, and (ii) promoting the future possible utilization of MAGSAT data in the various disciplines of geophysics beyond the subjects of the present MAGSAT Team. A joint meeting of the MAGSAT Team and the Advisory Committee will be held every four months throughout the period of NASA-Japan MAGSAT cooperative investigation.